REMARKS

1. Status of the Claims

Claims 1, 4, 5, 8-21, 24 and 27-35 stand pending. Claims 2-3, 6-7, 22-23, and 25-26 stand canceled. Claims 1, 4, 5, 15-18, 21, 24, 27 and 29-35 stand rejected. Claims 8-14, 19-20, and 28 are withdrawn.

In this response, no claims is amended, canceled, or added. Therefore, claims 1, 4, 5, 8-21, 24, and 27-35 remain pending with claims 8-14, 19-20 and 28 withdrawn.

2. Acknowledgement of Information Disclosure Statement

Applicants note with appreciation the acknowledgement of the Information Disclosure Statement filed April 21, 2009.

3. Claim Objections

The Office objects to claims 15-19 for not depending upon a preceding claim for the reasons presented in paragraph 2 of the Office Action. Although it is understood that dependent claims should refer to only preceding claims, this is typically corrected at the time of allowance. During prosecution, the order of claims may change and be in conflict with the requirement that dependent claims refer to a preceding claim, because Applicants are not allowed to renumber the claims. Accordingly, the numbering of dependent claims and the numbers of preceding claims referred to in dependent claims should be carefully checked when claims are renumbered upon allowance. *See* MPEP 608.01(n)(IV). Applicants respectfully request that the objection be withdrawn, and the claims be renumbered upon allowance.

4. Rejection of the Claims Under 35 U.S.C. § 103(a)

Claims 1, 4, 5, 15-18, 21, 24, 27 and 29-35 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over JP 11-290094, English translation, to Kuniaki, et al. (hereafter "*Kuniaki*") and JP-11-290094, English translation, to Yukihisa et al. (hereafter "*Yukihisa*") and Kleinig, Univ. Heidelberg, 1967, abstract (hereafter "*Kleinig*"). The Office alleges that *Kuniaki*

discloses esterification of astaxanthin by esterifying the hydroxyl groups with fatty acids. Specifically, *Kuniaki* discloses astaxanthin dipalmitoyl ester in Examples 1 and 2 and astaxanthin dicaproyl ester in Example 3. The Office admits that *Kuniaki* at least fails to disclose forming C8 to C10 fatty acid monoesters and using those monoesters in food or cosmetic compositions. *See, e.g.*, p. 4, para. 12 of the Office Action dated 9/2/09. The Office appears to rely on *Yukihisa* for allegedly disclosing astaxanthin fatty acid monoesters used in food and cosmetics. The Office further cites *Kleinig* for allegedly disclosing esterifying astaxanthin with myristic (C14), lauric (C12), and capric (C10) acids. From these references, the Examiner alleges that one of ordinary skill in the art would reasonably expect that the method of esterification taught in *Yukihisa* could be used to form astaxanthin C8 to C10 fatty acid monoesters.

Applicants respectfully traverse the rejection. As admitted by the Examiner, none of the cited references disclose astaxanthin C8 to C10 fatty acid monoesters as recited in claims 1, 21, 27, 33, 34, or 35. *Kuniaki* discloses only astaxanthin fatty acid diesters, and *Kleinig* is silent to whether the estertified astaxanthin are monoesters or diesters. Therefore, the Examiner has attempted to rely on *Yukihisa* for teaching monoesters. However, *Yukihisa* only suggests efficiently synthesizing diester type astaxanthins. *See, e.g.*, p. 8, para. 7 of the English translation. Although *Yukihisa* does mention astaxanthin fatty acid monoesters generally (*See, e.g.*, p. 8, para. 8 of the English translation), the object of *Yukihisa* is to form diesters. All of *Yukihisa's* examples show formation of a mixture of free astaxanthin, monoester, and diester, in which the yield of the diester is optimized. *See, e.g.*, Examples 1-9 of the English Translation. *Yukihisa* fails to explicitly disclose using monoesters in food or cosmetic compositions. Instead, *Yukihisa* suggests using monoesters as raw material in formation of the desired diesters. *See, e.g.*, p. 9, para. 9 of the English translation. Therefore, one of ordinary skill in the art at the time of Applicant's invention would have expected from the teachings of *Kuniaki*, *Kleinig*, and *Yukihisa* that it is preferred to form astaxanthin fatty acid diesters. Thus, there is no suggestion or expectation from the references that one of ordinary skill in the art would produce astaxanthin medium-chain fatty acid monoesters.

Further, at least because *Yukihisa* discloses only forming esters with long-chain (C14 and greater) fatty acids, as opposed to the medium chain fatty acids (C8 to C10) recited in the claims, there is no evidence that astaxanthin medium chain fatty acid monoesters would have been expected to be formed using the methods described in *Yukihisa*. Additionally, there is no evidence that the methods of *Kuniaki* and *Kleinig* could have formed monoesters. This leaves the Office relying solely on the conclusion that an astaxanthin long-chain (C14 or greater) fatty acid monoester disclosed in *Yukihisa* and/or astaxanthin long-chain (C16 or greater) or short-chain (C6 or less) fatty acid diesters disclosed in *Kuniaki* have structures similar enough to the claimed astaxanthin medium chain (C8 to C10) fatty acid monoesters to be *prima facie* obvious. However, when discussing fatty acids, persons of ordinary skill in the art typically group the fatty acids into long-chain, medium-chain, and short-chain. These groups are delineated at least because each group is expected to have differing properties. The Office has provided no evidence to support the conclusion that astaxanthin esterified with fatty acids from each of the different groupings would perform similarly.

In addition to the Office providing no evidence of the similarity of properties between the alleged similar structures and the claimed esters, the Specification provides evidence that the claimed compounds possess unexpectedly advantageous or superior properties. A *prima facie* case of obviousness based on structural similarity is rebuttable by proof that the claimed compounds possess unexpectedly advantageous or superior properties. *In re Payne*, 203 U.S.P.Q. 245, 256 (C.C.P.A. 1979). Specifically, free astaxanthin, astaxanthin C8 fatty acid monoester, and astaxanthin C8 fatty acid diester were directly compared regarding digestibility. *See, e.g.*, p. 56, ll. 20-25 of the Specification. The astaxanthin esterified with medium-chain fatty acids showed improved digestibility over free astaxanthin. *See, e.g.*, p. 57, ll. 6-9 of the Specification. Although it was known that esterified astaxanthins have improved absorption rates over free astaxanthin (*See, e.g.*, p. 3, ll. 11-15 of the Specification), this was only tested with long-chain fatty acids. Further, it would have been expected from the knowledge that esterified astaxanthin had superior digestibility that diesters would have improved absorption rates over monoesters, because of the additional fatty acid attached to enhance digestibility. This expectation is reinforced by *Kuniaki* and *Yukihisa*, both of which prefer diesters over

monoesters. However, Applicants unexpectedly discovered that at least astaxanthin medium-chain fatty acid monoesters have substantially better digestibility compared to astaxanthin medium-chain fatty acid diesters. *See, e.g.*, p. 57, ll. 9-15 and Figs. 1-2. As shown in the Figures, the astaxanthin concentration in blood plasma is at least about 50% higher for the monoester compared to the diester, and the astaxanthin transited to the liver from the monoester is an even higher percentage increase over the diester. *See, e.g.*, Figs. 1-2. Therefore, even if, *arguendo*, the structures of the esters described in *Kuniaki*, *Yukihisa*, and/or *Kleinig* were similar enough to establish a *prima facie* case of obviousness, the unexpected and superior results discovered by the Applicant of using astaxanthin C8 to C10 fatty acid monoesters rebut such a finding.

Dependent claims 4, 5, 15-18, 24, and 28-32 depend from claims 1, 21, or 27, respectively, are also not obvious for at least reasons similar to those for claims 1, 21, and 27. For at least these reasons the rejection should be withdrawn. Further note that withdrawn claims 8-14 also depend from claim 1. Claims 8-14 are also not obvious for at least reasons similar to claim 1, and thus should be rejoined when claim 1 is found allowable.

CONCLUSION

Reconsideration and reexamination of the claims is respectfully requested. If there are any other fees due in connection with the filing of this response, please charge the fees to our Deposit Account No. 50-0573. If a fee is required for an extension of time under 37 C.F.R. § 1.136 not accounted for above, such an extension is respectfully requested and the fee should also be charged to our Deposit Account. If any issues remain outstanding, the Examiner is invited to contact the undersigned.

Respectfully submitted,
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